REPORT

ON THE

Cawnpore Experimental Farm

FOR THE

Kharif and Rabi Seasons, 1892-93.

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Dated Cawnpore, the 8th November 1893.

FROM

J. O. MILLER, ESQ.,

DIRECTOR OF LAND RECORDS AND AGRICULTURE,

NORTH-WESTERN PROVINCES AND OUDH,

To

THE CHIEF SECRETARY TO GOVERNMENT,

NORTH-WESTERN PROVINCES AND OUDH.

SIR,

I HAVE the honor to forward the annual report on the Cawnpore Experimental Farm for the year 1892-93. The Farm is under the management of the Assistant Director, Saiyid Muhammad Hadi, but owing to his absence on sick leave, Babu Lachman Parshad was in charge from July to October and from the middle of February to April 20th.

2. Last year a very complete review of the experiments conducted at the Farm during the preceding ten years was submitted, which has furnished the Agricultural Chemist to the Government of India with materials for an analysis of the work of the Farm, which I have been permitted to attach to the annual report. In future the conduct of experiments will be carried on in communication with the Agricultural Chemist, and his advice has already been taken as to the programme for next season.

3. It is unnecessary for me to add to the remarks recorded by the Agricultural Chemist and the Assistant Director on the results established by the long course of experiments. It is satisfactory to find that, though the details of a few of these experiments might have been altered with advantage, the Farm has still, in Dr. Leather's opinion, done valuable work. With his remarks as to the necessity of great accuracy in the weighments I entirely agree, and it will be understood that attendance on these occasions is an essential part of the Assistant Director's duties. During the *rabi* season, now reported on, the Assistant Director personally supervised the weighments, and the Agricultural Chemist himself was present at many of them. As the latter has expressed some doubts regarding the accuracy of the system of weighment previously in force, it is only fair to note that Dr. Voelcker was specially struck by its thoroughness, and was inclined to think that it erred on the side of over-refinement (page 360 of his report).

4. The returns of the past year show that there was a poor *kharif* and an exceptionally good *rabi* harvest at the farm. The failure of the kharif was partly due to climatic conditions, and partly to inexperienced management. The permanent Farm Superintendent was deputed to Poona to study at the College of Science, and his *locum tenens* was deficient in experience. He was replaced by a practical agriculturist, under whom a very great improvement in the state of the Farm has been effected. The permanent Superintendent has recently returned and resumed charge.

5. The stallion sent to the Farm some two years ago has served over fifty mares during the year. His health has much improved since he was given regular ploughing exercise. Two pony mares have also been obtained to try the experiment recommended by the Civil Veterinary Department of using brood-mares in the plough. They were broken in without much trouble by the acting Superintendent, Muzaffar Khan, and are now easily driven by any of the Farm servants.

6. Apart from its value as an experimental station, the Farm serves a useful purpose as a centre for the distribution of good seed, and for the dissemination of information as to agricultural methods and practices. Considerable interest, for example, has been taken in the stacking of *bhusa* at the Farm in the manner customary in the northern and western districts, and the arrangements for making silage and for keeping manure also attract the attention of cultivators in the neighbourhood. The enquiries made from the Farm officials as to selected seeds, improved implements and agricultural practices, are very numerous, and show that there has arisen a widespread interest in the question of agricultural improvement accompanied by a belief in its possibility.

I have the honor to be,

SIR,

Your most obedient servant,

J. O. MILLER,

Director.

REPORT

ON THE

CAWNPORE EXPERIMENTAL FARM,

FOR THE KHARIF AND RABI SEASONS 1892-93.

Rainfall.—The rains commenced in June, and in that and the following three months were normal in their total amount, but were ill-distributed, heavy downpours alternating with periods of hot sunshine. The monsoon ceased at an early date. Towards the end of September the rains became light, and in October, a strong contrast to the previous season, no rain fell. In January and February there were copious cold season rains, and the weather was unusually damp and cloudy. The total rainfall was 31·72 inches, which is somewhat above the normal, though much below the amount recorded in the preceeding year. The number of rainy days was 52, as compared with 49 last year. The following table shows the amount and distribution of the rainfall during the year :—

Month.	Rainfall.			Rainy days.			Remarks.
	1891-92.	1892-93.	Normal.	1891-92.	1892-93.	Normal.	
May	·80	...	·52	1	...	1	
June	·18	3·90	3·11	1	6	4	
July	4·75	10·75	10·25	9	16	12	
August	24·92	12·25	10·08	18	18	12	
September	13·23	3·50	4·38	14	5	7	
October	·35	...	1·22	1	...	2	
November	...	·02	...	...	1	...	
December	...	...	·34	...	...	1	
January	·22	·90	·64	1	4	1	
February	·90	·40	·28	4	2	1	
March	...	...	·25	...	...	1	
April	...	...	·11	...	...	1	
Total ...	45·35	31·72	31·13	49	52	43	

2. **General character of the season.**—The timely commencement of the monsoon facilitated ploughing operation for the autumn crops; but the maize and cotton crops in some parts of the Farm suffered severely from unseasonable weather later on. The cold weather rains proved very beneficial to the spring crops, and the out-turn of wheat was unusually good. It has been the experience of recent years that the outturn of kharíf crops depends so largely on vicissitudes of season as to detract largely from the scientific value of experiments made in that season, and the record of the past year confirms this result. Many of the experiments must indeed be pronounced inconclusive, as they were in the two preceding years.

3. The experiments carried on at the Farm are classed as "*permanent*" and "*temporary*," the former being conducted on the same plots from year to year for an indefinite period; and the latter being arranged from time to time as the necessity for fresh experiments arises. Of the "*permanent*" class, the most important are those which are directed to discerning the effects of different manures on maize in the autumn season, and on wheat in spring. Originally the experiments were started to compare the effect of nitrogenous and non-nitrogenous manures: but as the manurial value of the latter class proved to be extremely small, the form of the experiment was changed; and it has for the last 10 years been directed to comparing the effect of certain nitrogenous manures with nitrogenous and non-nitrogenous manures mixed.

4. The method of conducting the permanent experiments has been fully described in previous reports. There are four series of plots with 13 plots in each. One is cropped every year with maize, another with wheat—these two being known as the

"Standard series;" while in the other two, which are known as the "Duplicate series" maize and wheat are grown in rotation.

In the year, in which one series bears wheat, the other has a maize crop, and *vice versâ*.

KHARIF SEASON EXPERIMENTS.

5. The following statements give the results of the "Standard" and "Duplicate" maize experiments during the year under report, and compare those with the average results of preceding years :—

KHARÍF STATEMENT No. I.—*Standard Series.—Manure experiment with Maize.*

Serial number.	Manure per acre.	Outturn per acre.				Increase or decrease per acre as compared with unmanured plot.			
		Grain.		Stalks.		Grain.		Stalks.	
		Average of three years.	Year under report.	Average of three years.	Year under report.	Average of three years.	Year under report.	Average of three years.	Year under report.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	Cow-dung, 180 maunds + bone dust, 4½ maunds	1,117	690	6,005	3,146	+553	+472	+3,055	+2,396
2	Ditto do. + gypsum, 3 maunds...	1,403	665	5,969	2,964	+839	+447	+2,109	+2,214
3	Ditto do.	1,145	435	6,164	750	+581	+217	+2,304	...
4	Ashes of 180 maunds of cowdung ...	851	169	6,244	1,306	+287	—49	+2,384	+556
5	Saltpetre, 3 maunds	851	387	5,533	1,210	+287	+169	+1,993	+460
6	Ditto do. + bone superphosphate, 3 maunds	1,222	435	4,638	2,008	+658	+217	+778	+1,258
7	Sheep-dung, 180 maunds + bone dust, 4½ maunds	1,323	1,065	6,965	1,754	+759	+847	+3,105	+1,004
8	Ashes of 180 maunds of cowdung + saltpetre, 3 maunds	1,230	266	7,054	1,040	+666	+48	+3,194	+290
9	Poudrette, 180 maunds	1,319	327	7,212	4,452	+755	+109	+3,352	+3,702
10	Sheep-dung, 180 maunds	1,230	290	7,877	2,964	+666	+72	+4,017	+2,214
11	Saltpetre, 3 maunds + bone dust, 4½ maunds...	1,000	339	6,590	1,633	+436	+121	+2,730	+883
12	Sheep-dung, 180 maunds + gypsum, 3 maunds	1,339	738	5,877	2,251	+775	+520	+2,017	+5,001
13	Unmanured	564	218	3,860	750	...	...	...	...

Note.—In 1887 and 1888 the maize crops failed altogether: those years have therefore been left out of account in striking averages.

KHARÍF STATEMENT No. II.—*Kharíf duplicate series.—Manure experiment with Maize.*

Serial number.	Manure per acre.	Outturn per acre.				Increased or decreased outturn per acre as compared with the unmanured plot.			
		Grain.		Straw.		Grain.		Straw.	
		Average of last 3 years.	Year under report.	Average of last 3 years.	Year under report	Average of last 3 years.	Year under report.	Average of last 3 years.	Year under report.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	Cow-dung, 180 maunds + bonedust, 4½ maunds	1,133	992	6,599	5,021	+552	+665	+2,622	+1,270
2	Ditto do. + gypsum, 3 maunds	1,117	532	6,671	5,590	+536	+205	+2,694	+1,839
3	Cow-dung, 180 maunds	897	556	5,606	3,001	+316	+229	+1,629	—750
4	Ashes of 180 maunds of cowdung	722	1,113	5,861	3,206	+141	+786	+1,884	—545
5	Saltpetre, 3 maunds	730	496	4,812	2,662	+149	+169	+835	—1,089
6	Ditto do. + bone superphosphate, 3 maunds.	1,089	768	4,009	4,077	+508	+459	+32	+226
7	Sheep-dung, 180 maunds + bone dust 4½ maunds	1,264	834	7,728	5,796	+683	+507	+3,751	+2,045
8	Ashes of 180 maunds of cowdung + saltpetre 3 maunds.	1,208	544	5,356	4,828	+627	+217	+1,379	+1,077
9	Poudrette, 180 maunds	1,472	1,210	6,356	6,849	+891	+883	+2,379	+3,098
10	Sheep-dung, 180 maunds	1,270	1,355	6,615	1,476	+689	+1,028	+2,638	—2,275
11	Saltpetre, 3 maunds + bone dust, 4½ maunds	867	786	6,706	2,650	+285	+459	+2,729	—1,101
12	Sheep-dung, 180 maunds + gypsum, 3 maunds	1,262	786	7,142	4,271	+681	+459	+3,165	+520
13	Unmanured	581	327	3,977	3,751	...	...	...	...

6. Both series of plots were sown on the same day—the 29th of June—with 12 lbs of seed per acre. On the following days there were heavy downpours of rain, followed by a few days of dry scorching weather, which led to the formation of a

hard crust on the surface of the soil, and seriously interfered with the germination of the seed and with the growth of the young shoots, where germination had taken place. To soften the crust, a watering was given to the "Standard" plots on the 9th July, but the result was unfortunate, as heavy rains lasting for several days commenced on the 10th. It was intended to water the plots of the "Duplicate" series on the 10th, but, owing to the rain, this was unecessary. In both series of plots the yield was exceptionally poor; but it was somewhat better, contrary to usual experience with maize, in the "Duplicate" than in the "Standard" series. The difference is attributable to the fact that the heavy rains of the 10th July and succeeding days caused more injury to the irrigated plots in the "Standard" series than to the other which had not been artificially watered. When crops suffer so seriously from climatic conditions, it is impossible to draw conclusions of any value as to the effect of various manures. Some of the plots are on a slight slope and are more liable to injury from heavy rains, while some of the manures can be more easily washed off than others. It thus becomes impossible to say how far differences in outturn are due to differences of value in the manures, and how far to unequal injury from unseasonable rains.

7. **Miscellaneous manure experiment with maize.**—This experiment was intended to be a permanent one to ascertain the comparative value of certain animal manures and saltpetre on maize; but as the Agricultural Chemist has expressed some doubt as to its value, it will probably be discontinued or altered. The experiment is conducted in 8 plots, each of which is treated exactly alike, except in respect of manure. The following is a detail of treatment adopted in the case of these plots:—After harvesting the preceding maize crop, the plots were left undisturbed till December, when there was a slight shower of rain; and they were ploughed once with the Watt's plough. Two more ploughings were given in the months of January and May respectively with the same plough. About the end of May, all the manures, except saltpetre, were spread on the respective plots and ploughed in with the country plough and levelled down. In the begnning of June, after a light shower, they were ploughed, once with Watt's and once with country plough, and levelled with the *patela*. On the 13th of June saltpetre was applied to its plot and seed was sown at the rate of 12 lbs per acre in furrows opened by the country plough. The plots were then levelled as before. When the crop was 15 days old, a watering, which was needed, was given and proved very beneficial. The plants were then well advanced before the heavy showers of rain in July, which, in the case of the experiments mentioned before, interfered with the healthy growth of maize; and these plots were not seriously injured. The plots received the first weeding on the 16th of July, and the second on 14th August. During the process of second weeding the plants were earthed up. The crop was harvested on the 18th September.

8. The produce of each plot for the year, and the average outturn of the last five years, are given in the sub-joined table:—

KHARÍF STATEMENT No. III.

Serial number.	Manure per acre.	Outturn per acre.				Increased or decreased outturn per acre as compared with the unmanured plot.			
		Grain.		Stalk.		Grain.		Stalk.	
		Average of last 5 years.	Year under report.	Average of last 5 years	Year under report.	Average of last 5 years.	Year under report.	Average of last 5 years	Year under report.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	Woollen refuse, 120 maunds and lime 12 maunds.	1,987	2,105	8,766	6,945	+1,500	+992	+5,064	+4,223
2	Sheep-dung, 120 maunds	1,412	3,073	6,997	7,031	+925	+1,960	+3,295	+4,369
3	Cow-dung, 120 maunds ..	1,055	1,912	6,020	3,729	+568	+799	+2,318	+1,017
4	Poudrette, 120 maunds	1,482	2,347	6,918	5,384	+995	+1,231	+3,216	+2,672
5	Horse-dung, 120 maunds	1,074	2,129	6,449	4,428	+587	+1,016	+2,747	+1,706
6	Pig's dung, 120 maunds ..	1,146	2 178	6,948	5.578	+659	+1,065	+3,246	+2,856
7	Saltpetre, 3 maunds ...	838	2,057	5,941	4,900	+351	+944	+2,239	+2,178
8	Unmanured.	487	1,113	3,702	2,722	...		...	...

9. The yield in these plots was unsually high in the year under report, being in case of four plots a hundred per cent. or more over the average of the past five years, but in some of these years the crops were very poor. The great increase in the yield of the year under report is due to the fact that these plots were sown 15 days before the "Standard" and "Duplicate" plots, and 22 days earlier than they were sown in the preceding year, and by the time the heavy showers of rain commenced, they were so well advanced in growth, owing to artificial irrigation, as to have been in a position to be benefited rather than injured by the rains. The fact that the yield increases by early sowing is sufficiently established by the early and late sowing experiment described in paragraph 11.

10. **Manure experiments with cotton.**—This experiment is to determine the effect of various manures on country cotton. The following is a description of the manner in which it was conducted :—

About the end of May, the plots were watered and ploughed once with the Watt's plough. At the first fall of rain they were ploughed a second time similarly, and levelled with the *patela*. On the 18th of June manures were spread and seed sown broadcast the next day at the rate of 24lbs the acre. They were then ploughed with the country plough and levelled again as before. The cotton sown was of the Cawnpore variety. After sowing, there was a long break in the rains, and the crop was, therefore, irrigated with canal water. This was, however, followed by heavy rains, which seriously damaged the young plants, with the inevitable result that the yield both of fibre and seed turned out to be considerably less than the average of the past four years. On the 31st July, the plots were weeded for the first time, and on the 23rd August the second and the last weeding was done. The picking commenced in the middle of October and lasted till the beginning of April. The outturn of each plot and the quantity and description of manure applied to it will be found in the following table :—

KHARIF STATEMENT NO. IV.—*Manure experiment with cotton.*

Serial number.	Manure per acre.	Outturn per acre.				Increased or decreased outturn per acre as compared with the unmanured plot.			
		Cleaned cotton.		Seed.		Cleaned cotton.		Seed.	
		Average of last four years.	Year under report.	Average of last four years.	Year under report.	Average of last four years.	Year under report.	Average of last four years.	Year under report.
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1	Fresh silt from canal, 500 maunds.	147	23	275	47	+40	−21	+79	−33
2	Kainit, 1 maunds, and gypsum, 4 maunds.	157	53	294	115	+50	+9	+98	+35
3	Farmyard manure, 180 maunds, and gpysum, 1 maund 14 seers.	170	70	336	156	+63	+26	+140	+76
4	Farmyard manure, 180 maunds and kainit, 1 maund 14 seers.	174	52	324	114	+67	+8	+128	+34
5	Woollen refuse, 120 maunds	226	76	411	150	+119	+32	+215	+70
6	Unmanured	107	44	196	80	...	...	...	...

All the manured plots, except that treated with fresh silt from canal, gave a better yield than the unmanured plot. The circumstance of this plot yielding a fairer outturn than the unmanured plot is attributable to the soil of the former containing a very much higher percentage of clay than that of the latter, and being thus liable to sustain a greater damage by excess of rain.

11. **Experiments in early and late sowing.**—This experiment is conducted with maize and cotton. In the case of maize it is directed merely to comparing the effect of early and late sowing, but with cotton the experiment is intended also to show the the outturn of different varieties.

The early sowings of maize were made on June 4th, and the late sowings on June 19th; the crops were harvested on September 4th and September 12th respectively. Cotton was sown on June 3rd and on June 19th; the picking in both cases commenced in October, and ended in April. The following statement shows the result of the experiment:—

KHARIF STATEMENT V(*a*).—*Early and late sowing of maize.*

Number of plot.	Month and date of sowing.	Produce per acre.			
		Grain.		Stalks.	
		Average of past five years.	1892-93.	Average of past five years.	1892-93.
		lbs.	lbs.	lbs.	lbs.
35 A	June 19th	1,168	1,678	4,040	7,724
35 B	June 4th	1,465	1,928	4,803	6,514

KHARIF STATEMENT V(*b*).—*Early and late sowing of cotton.*

Number of plots	Variety of cotton sown.		Produce per acre.			
			Cleaned cotton.		Seed.	
			1891-92.	1892-93.	1891-92.	1892-93.
			lbs.	lbs.	lbs.	lbs.
17	Sown before rain.	Varadhi	120	93	295	223
		Bani	115	65	281	158
		Dharwari	185	123	447	298
		Baroda	172	133	417	268
		Louisiana	172	128	420	280
		Jari	60	118	182	238
		Country	172	153	345	333
Pa & P. P. P.	Sown after rain.	Varadhi	50	70	102	145
		Bani	30	53	62	108
		Dharwari	42	110	110	218
		Baroda	32	60	57	145
		Louisiana	22	50	45	125
		Jari	22	75	46	185
		Country	22	113	24	250

The experiments made at the Farm appear to establish conclusively, the result, that when irrigation can be detained, it is advisible to sow maize and cotton before the rains, so that they may get a good start before the heavy rains, by which the young plants are liable to be injured, set in.

12. **Experiments with different varieties of imported cotton seed.**—This is a *temporary* experiment started in 1888, with a view to determining whether certain foreign varieties of cotton can be cultivated sucessfully in the *Doab*.

Eleven plots are allotted to this experiment, each being sown with a different variety of foreign cotton, and subjected to the same treatment year after year. The details of tillage and other field operations performed in the plots are given below:—

Date.	*Operations.*
8th June	... Watering.
9th „	... One ploughing with Watt's plough and levelling with *patela*.
10th „	... Cow-dung applied at the rate of 120 maunds per acre.
„ „	... One ploughing with Watt's plough and levelling as before.
13th „	... Seed dibbled at the rate of 12 lbs. per acre.
14th July	... } Weeding.
21st August	... }

16. The preparation of the land for the "Standard series" and the result of the experiments are described below :—

Seed is sown at the rate of 120 lbs per acre. During the period of rest, four ploughings with the Watt's plough are given to the soil at times favourable for the operation. The plots are ploughed up again at the close of the rains and levelled with the *patela*. Manure is then spread and ploughed in with the country plough, and the fields levelled again. Where weeds grow abundantly, the fields are harrowed. To get rid of their roots, one more ploughing is then given with the country plough, and the plots levelled to complete the preparation of the seed-bed. Seed is then sown behind a country plough, and covered over by means of a *patela*. Plots are then divided into irrigation beds called *kiaris* and watered once about three weeks after sowing; and again after a further interval of a fortnight, a second watering is given. The first weeding follows after a week. The crop is harvested generally in the beginning of April.

17. The yield of each plot during the year under report is considerably higher than that of the corresponding plots during each of the year since the commencement of the experiment. Sheep-dung with gypsun has given the highest yield as last year. Sheep-dung alone ranks next, and cow-dung stands third, yielding better results than the rest of the manures. As a practical conclusion, dung appears to be by far the most economical and effective manure for wheat. Dung is unfortunately burnt in this country by the common cultivator as fuel, and the ashes are available to him for use as manure. Ashes alone, though inferior, on the whole, to all other manures, have yet proved in themselves to possess some manurial value. Opportunity has been taken of determining from these experiments whether, by the addition of an artificial nitrogenous manure to the ash, the loss of nitrogen by the burning of the dung could be made up. As a result of the past 11 years' experiment it is now fully established that the addition of crude saltpetre makes up this loss to a certain extent. The yield of the plot treated with mixture of ashes and saltpetre has, however, been always below that of the plot treated with cowdung alone; but it must be borne in mind that in our experiment only three maunds of saltpetre, containing not more than 34 lbs of nitrogen, are added to the ashes of 180 maunds of cow-dung, which has lost by burning at least 44 lbs of nitrogen. The artificial supply of nitrogen is thus considerably less than it ought to be. It is consequently impossible to say definitely whether mixing nitrogen in the form of saltpetre to ashes of cow-dung in the same quantity, as is lost by burning, would fully recompensate the loss. Saltpetre alone has this year given a yield of 828 lbs less than cow-dung, but here again the amount of nitrogen contained in the weight of saltpetre used, was decidedly less than what was present in the quantity of cow-dung applied, though the low yield may also be due, in a measure, to its being ploughed in before sowing instead of being used as top dressing. It is a question, whether it would not be advisable in future to raise the quantity of saltpetre in plots Nos. 5 and 8 of the "Standard" and its corresponding plots of the "Duplicate" series from three to about four maunds the acre, so as to place that manure, with regard to the percentage of nitrogen, theoretically, on the same level with cow-dung, and to justify a comparison between the result of the cow-dung and saltpetre; or, to avoid interference with an experiment of such an old-standing two separate plots may be chosen elsewhere in the Farm, and treated with the increased quantity of saltpetre.

I attach much importance to the necessity of making further trials with saltpetre in a variety of ways, as this is the only available inorganic nitrogenous manure, and has on the whole produced such good results.

18. The yield in both the "Standard" and the "Duplicate" series has been unusually good this year, and the result goes to confirm the reports received from all quarters of the excellence of the last wheat harvest.

19. It will be observed that the average yield of wheat is higher in the "Duplicate," than in the "Standard" series, while in the case of maize, the "Standard" series plots

have on the whole given the best result. In the "Duplicate" series, maize follows wheat in the same year, and the land obtains but a short rest, while after the maize crop, the land lies fallow for over a year before the wheat is sown.

20. Rabi Statement No. III.—*Shewing results of experiment to determine the effect of Green manuring on wheat.*

Serial number.	Manure applied.	Outturn per acre.				Increased or decreased outturn per acre as compared with the unmanured plot.			
		Grain.		Straw.		Grain.		Straw.	
		Average for the last five years.	1892-93.	Average for the last five years.	1892-93.	Average for the last five years.	1892-93.	Average for the last five years.	1892-93.
1	Old indigo refuse 120 maunds.	1,532	1,942	3,267	4,919	+581	+442	+1,382	+3,334
2	Fresh indigo refuse 120 maunds, and lime 6 maunds.	2,120	1,500	3,398	3,110	+1,169	...	+1,513	+1,525
3	Indigo water, 3,600 cubic feet.	899	1,137	1,897	2,299	—52	—363	+12	+714
4	Hemp water, 3,600 cubic feet.	891	1,525	1,786	2,372	—60	+25	—99	+789
5	Unmanured ...	951	1,500	1,885	1,585	...	...	...	...
6	Hemp stump ploughed in	1,012	1,416	1,958	1,875	+61	—84	+73	+290
7	Green hemp ploughed in	1,207	1,379	2,423	2,396	+256	—121	+538	+811
8	Green Indigo ploughed in	1,312	1,573	2,515	2,214	+361	+73	+630	+629
9	Indigo stump ploughed in	1,219	1,295	2,529	2,154	+268	—205	+644	+569
10	Green Indigo ploughed in with 6 maunds of gypsum.	1,103	1,658	2,025	3,702	+152	+158	+140	+2,117
11	Green hemp ploughed in with 6 maunds of gypsum.	1,082	1,295	2,125	2,384	+131	—205	+240	+799
*12	Wheat alternating with lucern.	793	lucern standing.	1,823	lucern standing.	—158	...	—62	...
*13	Wheat alternating with lucern.	919	1,053	1,825	2,105	—32	—447	—60	+520

21. There are 13 plots under this experiment, which are cropped year after year with wheat. The following table gives all the operations carried on in each plot :—

Serial number.	Manure applied.	Tillage and other operations.
1	Old indigo refuse 120 maunds ...	(*a*) Two ploughings after the advent of rains with Watt's plough. (*b*) Spreading manure (in August). (*c*) Ploughing in of the manure with Watt's plough. (*d*) One more ploughing with Watt's plough after an interval of a fortnight. (*e*) One ploughing in the beginning of October. (*f*) Levelling. (*g*) Ploughing with native plough. (*h*) Levelling. (*i*) Ploughing with native plough. (*j*) Sowing seed at the rate of 120 lbs. the acre. (*k*) Preparation of irrigation beds. (*l*) Two waterings. (*m*) Weeding one.
2	Fresh indigo refuse and lime ...	As in No. 1—Lime is spread 2 days before sowing and ploughed in and the land levelled.
3	Indigo water	Ditto ditto ditto.
4	Hemp water	Ditto ditto ditto.
5	Unmanured	(*a*) (*c*) Ploughing (*d*) (*e*) (*f*) (*g*) (*h*) (*i*) (*j*) (*k*) (*l*) (*m*).
6	Hemp stump ploughed in ...	(*b*) Hemp stalks removed and stumps left. (*c*) Stumps ploughed in; the rest as in No. 1.
7	Green hemp „ „ ...	As in No. (1).
8	Green indigo „ „ ...	Do. do.
9	Indigo stump „ „ ...	As in No. (6).
10	Do and gypsum	As in No. (1).
11	Green hemp with gypsum ...	As in No. (1).
*12	Wheat alternating with lucern ...	Lucern standing.
*13	Wheat alternating with lucern ...	As in No. (6).

**N.B.*—In both these plots wheat is taken after lucern, so that when one plot bears wheat the other bears lucern.

22. Referring to *rabi* statement No. III it will be seen that all the plots that are kept under green fallow have, during the past five years, been producing better results than that kept bare fallow. The yield of the unmanured plot during the year was unusually high. Other facts worthy of mention are —

(1) that taking the average outturns for the last five years into consideration, the plots cropped or treated with indigo refuse or indigo water have given much better results than those cropped or treated with hemp or hemp-water, respectively ;

(2) that plots manured with green stalks of indigo or hemp have yielded higher outturns than those from which these crops had been cut and removed, roots alone being left, with a view to enriching the land ;

(3) that old indigo refuse gave the highest yield during the year under report, fresh indigo stalk and gypsum ranked second, and fresh indigo refuse alone came third.

But taking the average for the last five years into consideration, fresh indigo refuse with lime have proved superior to the rest of the green manures.

23. One of the most valuable results of experiment is to ascertain the effect on unmanured land by continuous cropping with the same crop. In the "Standard," "Duplicate," and "Green manuring" series, the yield of the unmanured plot has been as follows :—

Year.	Standard series.	Duplicate series.	Green manuring series.
	lbs.	lbs.	lbs.
1881-82	777	771	...
1882-83	1,065	999	...
1883-84	1,031	2,281	1,515
1884-85	635	1,025	623
1885-86	913	1,119	1,367
1886-87	1,041	1,258	847
1887-88	968	907	786
1888-89	883	617	653
1889-90	1,307	1,876	1,464
1890-91	1,222	1,597	1,162
1891-92	992	956	690
1892-93	1,500	1,754	1,500

The yields vary considerably from year to year according to the character of the season, but the outturn in recent years has, on the whole, been quite as high as in the earlier seasons of experiment, and no deterioration from over-cropping can yet be traced.

24. **Deep and shallow ploughing.**—This experiment was carried on in two series of plots from 1886-87 to last year, and the results were fully noticed in last year's report. In the year under report the experiment was continued in only one series of these plots. The first plot was ploughed four times, nine inches deep, by working one Watt's plough behind another in the same furrow; the second was ploughed four times, five inches deep, with the Watt's plough, and the third plot, eight times, three inches deep with the country plough. All the plots were then levelled with the *patela*, and sown with wheat behind a country plough at the rate of 120lbs per acre. They were then levelled

with the *patela* as before, and were watered once about three weeks after sowing. Weeding followed after a week. The crops were harvested in the first week of April. The following tabular statement gives the outturn of each plot.

RABI STATEMENT No. IV.—*Deep and shallow ploughing.*

Serial number	Ploughing.			Outturn per acre.		Increased outturn as compared with the plot ploughed with country plough	
	Name of plough used.	Depth of ploughing.	Number of ploughing	Grain.	Straw	Grain.	Straw.
				lbs	lbs.	lbs.	lbs.
1	Watt's plough	9″	4	1,359	2,787	+136	+49
2	Ditto	5″	4	1,427	2,983	+204	+245
3	Country plough	3″	8	1,223	2,738	..	...

The plot ploughed four times, 5 inches deep, has not only produced better results than that ploughed eight times, 3″ deep, but also better than that ploughed four times, 9″ deep. The latter circumstance was most likely due to the fact that, in case of plot (1), the subsoil, which was not so well exposed to the atmospheric action as the surface soil and which therefore contained a smaller proportion of *active* plant food, when incorporated with surface soil, reduced the percentage of orgaine matter and other available nourishing materials.

35. **Experiments with foreign grains.**—This is a temporary experiment started in 1890-91, with the view of acclimatizing certain foreign cereals. The outturn in each year is shown in the following statement:—

RABI STATEMENT No. V.—*Experiments with foreign grains.*

Name of crop.		1890 91.		1891-92.		1892-93.		Remarks.
		Grain.	Straw	Grain.	Straw.	Grain	Straw.	
		lbs.	lbs.	lbs	lbs.	lbs.	lbs.	
Wheat	(1)—Adelaide	...	...	1,016	2,973	293	1,341	
	(2)—Ladoga	581	1,404	210	473	346	1,681	
	(3)—Red Fern	97	456	42	212	73	2,305	
	(4)—Judket	315	460	73	206	57	696	
	(5)—White Fife	194	891	97	230	241	1,205	
	(6)—Red Fife	133	935	242	1,053	356	1,425	
	(7)—Sapouka	145	654	67	383	12	1,255	
Barley	(1)—Polar, six rowed ...	629	2,831	300	1,066	550	1,187	
	(2) Danish Chevalier, two rowed	242	1,164	180	732	645	1,137	
	(3)—Beardless, two rowed .	1,125	2,468	360	1,346	576	1,320	
	(4)—Sweedish, two rowed ...	1,152	2,209	624	1,344	676	1,074	
Oats	(1) Prize Chester ...	520	2,142	240	1,128	344	10.239	
	(2)—Canadian Triumph . .	787	2,527	246	1,050	316	9,070	
	(3)—Rennie's Prize . .	472	1,966	198	912	800	8 731	
	(4)—Welcome . . .	708	2,367	240	756	485	9,730	
	(5)—Bonanza	787	2,553	252	912	277	10,578	
	(6)—White Egyptian ..	847	2,638	300	936	254	7.110	
Rye	.. ..		...	2,103	3,820	193	1,650	

26. The attempts to acclimatize foreign wheat have been unsuccessful, and the experiment will probably be discontinued, as the Agricultural Chemist has expressed some doubt of the value of this experiment. Barleys have done somewhat better. The Canadian oats yielded a magnificient crop of green fodder, but the outturn of grain was poor.

27. **Experiments with varieties of barley.**—Another experiment that has been carried on since 1888 with several varieties of barley, has given somewhat better

results; though the yield has, in all cases, been inferior to that of the ordinary Cawnpore variety :—

RABI SATEMENT No. VI.—*Experiment with varieties of Barley.*

Serial number.	Varieties of Barley.	Grain or Straw.	1888-89.	1889-90.	1890-91.	1891-92.	1892-93.
1	Green, huskless ...	Grain ...	1,812	1,110	1,523	563	848
		Straw ...	2,872	1,600	2,814	907	1,613
2	Chocolate ...	Grain ...	1,547	1,684	1,433	678	859
		Straw ...	3,164	2,517	2,452	1,458	1,655
3	White, huskless ..	Grain ...	1,780	1,362	1,497	829	833
		Straw ...	2,980	2,116	2,530	1,706	1,294
4	Cawnpore, husky ...	Grain ...	1,974	1,949	1,884	1,065	1,804
		Straw ...	4,080	1,775	2,033	1,706	2,008

28. Experiments made in grinding specimens of the various barleys give the following results :—

Name of Barley.	Weight of barley ground.	Proportion of—		Remarks.
		Flour.	Bran.	
	Seers.	Chittacks.	Chittacks.	
I. Huskless—				
(1) Chocolate	1	15¼	¼	
(2) Green	1	15½	½	
(3) White	1	15½	½	
II. Husky—				
(1) Country, white	1	14	2	
(2) ,, black	1	14	2	
(3) Danish Chevalier	1	14	2	
(4) Swedish, two rowed	1	14⅛	1⅞	
(5) Polar, six rowed	1	14¼	1¾	
(6) Beardless, two rowed	1	14¼	1¾	

RESULTS ESTABLISHED BY THE EXPERIMENTS TRIED AT THE FARM.

29. With regard to the general results established by the series of *rabi* experiments, I subjoin two statements; one showing the average yield of wheat for the last 12 years (including the year under report), and the other, the financial results of each manure applied.

Statement showing the average yield of wheat during the past 12 *years.*

Serial number.	Manure.	Rabi standard.		Rabi duplicate.		Remarks.
		Average yield from 1882 to 1893.	Number in order of yield.	Average yield from 1882 to 1893.	Number in order of yield.	
		lbs.		lbs.		
1	Saltpetre	1,429	7th.	1,597	7th.	
2	Cow-dung	1,409	8th.	1,688	4th.	
3	Sheep-dung	1,408	9th.	1,515	8th.	
4	Poudrette	1,465	3rd.	1,689	3rd.	
5	Saltpetre + bone dust ...	1,481	1st.	1,838	1st.	
6	Saltpetre + bone superphosphate .	1,452	5th.	1,683	5th	
7	Saltpetre + ashes	1,351	10th.	1,434	11th.	
8	Cow-dung + bone dust ...	1,480	2nd.	1,489	10th.	
9	Cow-dung + gypsum ...	1,435	6th	1,494	9th.	
10	Sheep-dung + bone dust ...	1,313	11th.	1,730	2nd.	
11	Sheep-dung + gypsum ...	1,455	4th.	1,653	6th.	
12	Ashes	1,446	12th.	1,390	12th.	
13	Unmanured	1,028	13th.	1,216	13th.	

Statement showing the financial result of each manure applied.

Serial number.	Manure.	Price.	Rabi standard.			Rabi duplicate.		
			Value of increased outturn.	Difference.	Number in the order of yield.	Value of increased outturn.	Difference.	Number in the order of yield.
		Rs				Rs.	Rs	
1	Saltpetre	6 00	14 32	8 32	1st	13 61	7·61	4th.
2	Cow-dung	7·00	13·60	6·60	3rd	16 86	9 86	2nd.
3	Sheep-dung	8 00	13 60	5 60	7th	10 43	2 43	8th.
4	Poudrette	7 50	15 60	8 10	2nd	16 89	9 39	3rd.
5	Saltpetre + bone dust	10 50	16·78	6 28	4th	22 21	11 71	1st.
6	Saltpetre + bone superphosphate ...	17·25	15 14	2 11	..	16 78	—·47	
7	Saltpetre + ashes	7·25	11 53	4 28	9th	7 78	·23	10th.
8	Cow dung + bone dust	11 50	16 14	4·64	8th	9 75	—1·75	..
9	Cow-dung + gypsum	8 50	14·53	6·03	5th	9·93	1 43	9th.
10	Sheep dung + bone dust ...	12 50	10 18	2 32	...	18·36	5 86	6th.
11	Sheep dung + gypsum ...	9 50	15 52	6·02	6th	15 61	6 11	5th.
12	Ashes	1·25	4 21	2 96	10th	6·56	5·31	7th.
13	Unmanured	...	...	...	...	...	...	..

N.B.—Price of wheat calculated at 14 seers per rupee.

30. **Remarks on yield.**—Generally speaking all the nitrogenous manures, such as saltpetre, cow-dung and sheep-dung applied to wheat crop, mixed with phosphatic or calcic manures, such as bone dust, bone superphosphate, gypsum, &c., produced much better results than when applied alone. This fact is equally well-established in case of maize grown year after year on the same land.

Again, manures containing a high percentage of readily *available* nitrogen, such as mixture of saltpetre and bone dust, have better effect on wheat, than those containing a smaller quantity of available nitrogen, such as a mixture of cow-dung and bone dust.

It is also noteworthy that saltpetre mixed with superphosphate does not produce such good effect on wheat as it does when applied mixed with bone dust, considering however that the percentage of nitrogen in bone dust is about double of that contained in bone superphosphate. The conclusion is that the higher the quantity of nitrogen in a phosphatic manure, the more suitable it is for being used as an auxiliary to a concentrated nitrogenous manure; also that phosphorus, though applied in a readily available form, cannot have its full effect on wheat, unless supplemented with a sufficient quantity of nitrogen.

31. **Financial results.**—From a financial point of view, application of saltpetre to lands, from which only one crop of wheat is taken in a year, seems to be most economical, and there cannot be the least doubt as to the advisability of encouraging its use among the native cultivators. The only draw back is that it cannot be had everywhere at a sufficiently cheap rate.

Poudrette also is nearly as economical as saltpetre, but a mojority of common cultivators have serious objections to mainpulating it on religious grounds and owing to natural repugnance.

Cow-dung comes next in respect of economy.

A mixture of bone dust and saltpetre, though not yielding as much profit as saltpetre or poudrette, approaches cow-dung closely, while it leaves the highest margin of profit where wheat is taken in rotation with maize. This is a fact of considerable value for the advocates of artificial manures, and shows that it is unfair to condemn the use of such manures for purely economic reasons.

Cow-dung or sheep-dung mixed with gypsum is nearly as profitable as saltpetre and bone dust.

Sheep-dung is expensive, and on that ground less profitable, than the abovenamed manures, thought it pays better than a mixture of cow dung and bone dust.

Addition of crude potassium nitrate to the ashes of cow-dung makes it nearly as valuable as a mixture of cow-dung and bone dust, and when applied so mixed, it yields only 2·32 less per acre as compared with cow-dung.

Lastly, ashes, though giving less profit than the manures hitherto mentioned, yield a net profit of nearly Rs. 3 per acre, and should not therefore be neglected by the cultivator.

Most of these results hold equally good in the case of the "Duplicate series."

32. It is more difficult to draw conclusions of value, which it has been possible to do in the case of the two Rabi series, from the Kharif experiments, owing to the maize crops having failed frequently. The following statements are based on the averages taken from the yield of four years only, *viz.*, 1884-85, 1886-87, 1889-90, 1890-91, in which the results with regard to yield did not vary to any considerable extent. The other years, in which the crops were either totally destroyed, or had yielded an exceedingly poor outturn, have been left out of account in striking the averages given in the appended statements.

Statement showing the yield of maize.

Serial number.	Manure.	Kharif standard.		Kharif duplicate.		Remarks.
		Average yield.	No in the order of yield.	Average yield.	No in the order of yield.	
		lbs.		lbs.		
1	Saltpetre	1,185	8th.	775	11th.	
2	Cow dung	1,345	6th.	1,118	5th.	
3	Sheep-dung	1,049	11th.	1,181	2nd.	
4	Poudrette	1,530	2nd.	1,551	1st.	
5	Saltpetre + bone dust	1,176	10th.	889	10th.	
6	Saltpetre + bone superphosphate ...	1,180	9th.	990	9th.	
7	Saltpetre + ashes	1,349	5th.	1,141	4th.	
8	Cow-dung + bone dust	1,627	1st.	1,169	3rd.	
9	Cow-dung + gypsum	1,368	4th.	1,116	6th.	
10	Sheep-dung + bone dust	1,447	3rd.	1,056	8th.	
11	Sheep-dung + gypsum	1,256	7th.	1,103	7th.	
12	Ashes	930	12th.	604	12th.	

The following table gives the financial results based upon the average yield shown in the foregoing table :—

Serial number.	Manure.	Price of manure.	Kharff standard.			Kharff duplicate.			Remarks.
			Price of increased outturn.	Difference.	Number in the order of yield.	Price of increased outturn.	Difference.	Number in the order of yield.	
1	Saltpetre	6·00	10·15	4·15	6th.	5·86	—·14	...	Price of maize is calculated at 52 lbs. per rupee.
2	Cow-dung	7·00	13·23	6 23	3rd.	12·46	5·46	4th.	
3	Sheep-dung	8·00	7·48	—·52	...	13·67	5·64	2nd.	
4	Poudrette	7·50	16·79	9·29	1st.	20·78	13·28	1st.	
5	Saltpetre + bonedust ...	10·50	9 98	—·52	...	8 05	—2·45	...	
6	Saltpetre + bone superphosphate	17·25	10·58	—6·67	...	10 00	—7·25	...	
7	Saltpetre + ashes ...	7·25	13·32	6·07	4th.	12 90	5·65	3rd.	
8	Cow-dung + bone dust ...	11·50	18·65	7 15	2nd.	13 44	1·94	7th.	
9	Cow-dung + gypsum ...	8·50	13·67	5·17	5th.	10 87	2 37	5th.	
10	Sheep-dung + bone dust ...	12·50	15·19	2 69	8th.	12 42	—·08	...	
11	Sheep-dung + gypsum ...	9·50	11·49	1·99	9th.	12·17	2·67	5th.	
12	Ashes	1·25	5·25	4·00	7th.	2·5	1·25	8th.	

33. Remarks on the yield of maize.—An addition of phosphatic or calcic manures to orgaine nitrogenous manures is more effective than an addition of the same to an inorganic nitrogenous fertilizer. Concentrated nitrogenous, phosphatic or calcic manures, either applied singly or in mixtures, have not shown any remarkable

fertilzing effects. The dung manures on the other hand seem to be very effective in increasing the yield of maize crop, showing that presence of organic matter in the soil is very essential for this plant. Among the dung manures tried at the Farm on maize, poudrette has, on the whole, yielded the largest outturn. A mixture of cowdung and bone-dust ranks next.

34. **Financial results.**—Application of poudrette to maize crop pays best, and cowdung comes next. A mixture of saltpetre and ashes is not any way less paying than cow-dung. Cowdung mixed with bone dust also occupies a good position in point of economy.

35. The following appendices are attached to this report :—

Appendices I to VI.—Six statements showing the financial results of various manures applied to maize and wheat in the permanent experiments.

Appendix VII.—Report on Cawnpore Experimental Farm by Dr. J. W. Leather, Agricultural Chemist to the Government of India.

CAWNPORE ;
The 12th October 1893.

SAIYID MUHAMMAD HADI, M.R.A.C., M.R.A.S.,
Assistant Director.

APPENDIX No. I—KHARIF STANDARD SERIES, *vide* KHARIF STATEMENT No. I,

Statement showing financial result of manures applied.

Serial number	Manure per acre	Price of manure	Grain or stalk	Increase or decrease over the outturn o the unmanured plot per acre		Value of the increased or decreased outturn		Total value of the increased ou'turn		Net profit or loss after deducting the cost of manure		Remarks.
				Average of last five years	1892-93	Average of last five years	1892 93	Average of last five years.	1892 93.	Average of last five years.	1892 93	
		Rs.		lbs.	lbs	Rs	Rs	Rs	Rs	Rs	Rs	
1	Cow dung 180 maunds + bone dust, 4½ mauds	11 50	Grain	503	472	10 03	9 07	12 95	10 89	1 45	— 61	The outturn has been calculated at the following rates— Grain 52 lbs per rupee Stalks 1312 lbs per rupee.
			Stalks	3,045	2,396	2 32	1 82					
2	Cow dung, 180 maunds + gypsum, 3 maunds.	8 50	Grain ...	839	447	16 13	8 59	17 73	10 27	9 23	1 77	
			Stalks ...	2,109	2,214	1 60	1 68					
3	Cowdung, 180 maunds ..	7 00	Grain ...	581	217	11 17	4 17	12 92	4 17	5 92	—2 83	
			Stalks ...	2,304	...	1 75	...					
4	Ashes of 180 maunds of cow dung,	1 25	Grain .	287	49	5 51	— 94	7 32	— 52	6 07	—1 77	
			Stalks ..	2,384	556	1 81	— 42					
5	Saltpetre, 3 maunds	6 00	Grain ..	287	169	5 51	3·25	7 02	3 60	1 02	—2 40	
			Stalks	1,993	460	1 51	·35					
6	Ditto + bone superphosphate, 3 maunds	17 25	Grain ...	658	217	12 65	4 17	13 24	5 12	—4 01	-12 13	
			Stalks	778	1,258	·59	95					
7	Sheep dung, 180 maunds + bone dust, 4½ maunds	12 50	Grain ..	759	847	14 59	16 28	16 95	17 04	4 45	4 54	
			Stalks	3,105	1,004	2 36	76					
8	Ashes of 180 maunds of cow dung + saltpetre, 3 maunds	7 25	Grain ..	666	48	12 80	92	15 23	1 14	7 98	—6 11	
			Stalks	3,194	290	2 43	·22					
9	Poudrette, 180 maunds ...	7 50	Grain ..	755	109	14 51	2 09	17 06	4 91	9·56	—2 59	
			Stalks ..	3,952	3,702	2 55	2·82					
10	Sheep dung, 180 maunds .	8 00	Grain .	666	72	12 80	1 38	15 86	3 06	7 86	—4 94	
			Stalks ..	4 017	2,214	3 06	1 68					
11	Saltpetre, 3 maunds + bone dust 4½ maunds	10 50	Grain ..	436	121	8 38	2 32	10 16	2 99	—·04	—7 51	
			Stalks ..	2,730	883	2 08	·67					
12	Sheep dung 180 maunds + gypsum 3 maunds	9 50	Grain	775	520	14 90	10 00	16·43	11 14	6 93	1 64	
			Stalks .	2,017	1,501	1 53	1 14					

APPENDIX No. II.—KHARÍF DUPLICATE SERIES, *vide* KHARÍF STATEMENT No II, CROP, MAIZE.

Statement showing Financial result of manures applied.

Serial number.	Manure per acre.	Cost of manure.	Grain or stalk.	Increase or decrease in the out-turn over unmanured plot per acre.		Value of increased or decreased out turn.		Total value of increased or decreased out-turn.		Net profit or loss after deducting the cost of manure		Remarks.
				Average of last five years.	1892-93.	Average of last five years.	1892 93.	Average of last five years.	1892-93.	Average of 1 st five years.	1892-93.	
		Rs.		lbs.	lbs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
1	Cow-dung 180 maunds, + bone-dust, 4½ maunds.	11·50	Grain ...	552	665	10·61	12 98	11·71	13·74	·20	2 24	The price of the out-turn has been calculated throughout at the following rate :— Grain 52lbs per rûpee. Stalks 1,312 lbs per rupee.
			Stalks ...	2,622	1,270	1·10	·96					
2	Cow-dung 180 maunds, + gypsum 3 maunds.	8·50	Grain ...	536	205	10 30	3 94	12·35	5 34	3 85	—3·16	
			Stalks ...	2,694	1,839	2·05	1·40					
3	Cow-dung 180 maunds ...	7·00	Grain ...	316	229	6 07	4·40	7·31	3·83	·31	—3·17	
			Stalks ...	1,629	—750	1·24	—·57					
4	Ashes of 180 maunds of cowdung	1·25	Grain ...	141	786	2·71	15·11	4 15	14 70	2·90	13 45	
			Stalks ...	1,884	—545	1·44	—·41					
5	Saltpetre 3 maunds	6·00	Grain .	149	169	2 86	3·24	3 50	—2·41	—2 50	—3 59	
			Stalks ...	835	—1,089	·64	—·83					
6	Ditto + bone superphosphate 3 maunds.	17·25	Grain ..	508	459	9·77	8 82	9 79	9 06	—7 46	—8·19	
			Stalks ..	32	326	·02	·24					
7	Sheep-dung, 180 maunds, + bone-dust 4½ maunds.	12·50	Grain ..	683	507	13 13	9·75	15 93	11·30	3 43	—1·20	
			Stalks ...	3,751	2045	2·80	1·55					
8	Ashes of 180 maunds of cow-dung + saltpetre 3 maunds.	7·25	Grain ..	672	217	12 92	4·17	13·97	4·99	6·72	—2 26	
			Stalks ...	1,379	1,077	1 05	·82					
9	Poudrette 180 maunds ...	7·50	Grain ..	891	883	17·13	16 98	18·94	17·28	11·44	9·78	
			Stalks ...	2,379	398	1 81	·30					
10	Sheep dung 180 maunds ...	8·00	Grain ...	689	1,028	13 25	19 77	15 26	17 81	7·26	9·81	
			Stalks .	2,638	—2,275	2 01	—1·96					
11	Saltpetre 3 maunds + bone-dust 4½ maunds.	10·52	Grain ...	285	459	5·48	8 82	7 56	7·99	—2 96	—2 51	
			Stalks ...	2,729	—1,101	2 08	—·83					
12	Sheep-dung 180 maunds + gypsum 3 maunds.	9·50	Grain ..	681	459	13 10	8 82	15 51	9·21	6 01	—·29	
			Stalks .	3,165	520	2·41	·39					

Appendix III.—Kharíf Experiment with Maize, *vide* Kharíf Statement No. III.

Statement showing the Financial result of manures applied.

Serial number.	Manure per acre.	Cost of manure.	Grain or stalks.	Increase or decrease of outturn over unmanured plot per acre.		Value of increased or decreased outturn.		Total value of increased or decreased outturn.		Net profit or loss after deducting the cost of manure.		Remarks.
				Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	
		Rs.		lbs.	lbs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	
1	Woollen refuse 120 maunds + lime 12 maunds.	5·40	Grain ...	1,500	992	28·85	19·07	32 71	22 28	27·31	16·88	The value of the outturn has been calculated at the following rates: —
			Stalks ...	5,064	4,223	3·86	3·21					
2	Sheep dung 120 maunds ...	5·30	Grain ...	925	1,960	17·79	37·69	20 30	41·04	15·00	35·74	Grain, 52 lbs the rupee. Stalks 1,312 lbs the rupee.
			Stalks ...	3,295	4,396	2·51	3·35					
3	Cow-dung 120 maunds ...	4·60	Grain ...	568	799	10·92	15·36	12·69	16 13	8·09	11·53	
			Stalks ...	2,318	1,017	1·77	·77					
4	Poudrette 120 maunds ...	5·00	Grain ...	995	1,234	19·13	23·73	21·58	25·75	16·58	20·75	
			Stalks ...	3,216	2,663	2·45	2·02					
5	Horse-dung 120 maunds ...	4·60	Grain ...	587	1,016	11·29	19·53	13·38	20·83	8·78	16·23	
			Stalks ...	2,747	1,706	2·09	1·30					
6	Pig's dung 120 maunds ...	5·30	Grain ...	659	1,065	12·67	20·48	15·14	22·65	9·84	17·35	
			Stalks ...	3,246	2,856	2·47	2·17					
7	Saltpetre 3 maunds ...	6·00	Grain ...	351	944	6·75	18·15	8·45	19·81	2·45	13·81	
			Stalks ...	2,239	2,178	1·70	1·66					

APPENDIX No. IV.—RABI STANDARD SERIES, *vide* RABI STATEMENT No. I, CROP, WHEAT.

Statement showing the Financial results of manures applied.

Serial numbers	Manure per acre	Cost of manure.	Grain or straw	Increase or decrease over the out-turn of the unmanured plot per acre		Value of decreased or increased outturn		Total value of increased or decreased out-turn		Net profit or loss after deducing the cost of manure		Remarks.
				Average of last five years.	1892-93	Average of last five years	1892-93	Average of last five years.	1892-93	Average of last five years	1892 93	
		Rs		lbs	lbs.	Rs	Rs	Rs	Rs.	Rs	Rs	
1	Saltpetre 3 maunds ..	6 00	Grain	245	146	8 75	5 21	11 95	4 86	5 95	- 1 14	The outturn has been calculated throughout at the following rate — Grain 28 lbs the rupee Straw 205 lbs the rupee
			Straw	656	—72	3·20	35					
2	Saltpetre 3 maunds + bone dust 4½ maunds	10 50	Grain	274	490	9 78	17 50	11 99	18 35	1 49	7 85	
			Straw..	455	176	2 21	85					
3	Cow dung 180 maunds	7 00	Grain	262	974	9 35	34 78	12 96	39·65	5 96	32 65	
			Straw	741	999	3 61	4 87					
4	Cow dung 180 maunds + bone dust 4½ maunds	11 50	Grain ..	417	896	14 89	32 00	19 20	35 72	7 70	24 22	
			Straw	884	763	4 31	3 72					
5	Cow dung 180 maunds + gypsum 3 maunds	8 50	Grain	313	878	11 17	31 35	15 30	34 80	6 80	26 30	
			Straw	848	709	4 13	3 45					
6	Sheep dung 180 maunds .	8 00	Grain ..	303	1,108	10 82	39 57	15 21	46 74	7 21	38 74	
			Straw	901	1,471	4 39	7 17					
7	Ashes of 180 maunds of cow-dung	1 25	Grain	1	581	03	20 75	45	21 99	—·80	20 74	
			Straw	88	255	12	1 24					
8	Sheep dung 180 maunds + bone dust 4½ maunds	12 50	Grain	252	745	9 00	26 60	12 52	30 11	— 02	17 61	
			Straw	722	720	3 52	3 51					
9	Saltpetre 3 maunds + bone super-phosphate 3 maunds	17·25	Grain ..	219	950	7·82	33 92	10 57	35 60	—6 68	18 35	
			Straw	564	345	2·75	1 68					
10	Sheep-dung 180 maunds + gypsum 3 maunds	9 50	Grain	405	1,277	14·46	45 60	17 13	50 44	7 63	40 94	
			Straw	548	993	2 67	4 84					
11	Poudrette 180 maunds	7 50	Grain	391	944	13 96	33 71	18 68	39 26	11 18	31 76	
			Straw	969	1,138	4 72	5 55					
12	Ashes of 180 maunds of cow dung + saltpetre 3 maunds.	7 25	Grain	325	629	11 60	22 46	13 67	22 29	6 42	15 04	
			Straw .	425	—36	2 07	—·17					

APPENDIX No. V.—RABI DUPLICATE SERIES, CROP WHEAT, *vide* RABI STATEMENT No. II.

Statement showing the Financial result of manures applied.

Serial number.	Manure per acre.	Cost of Manure.	Grain or Straw.	Increase or decrease over the out-turn of the unmanured plot per acre		Value of increased or decreased out-turn.		Total value of increased or decreased out-turn		Net profit or loss after deducting the cost of manure.		Remarks.
				Average of last 5 years.	1892 93.	Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	
		Rs.		lbs.	lbs.	Rs.	Rs	Rs.	Rs.	Rs.	Rs.	
1	Saltpetre 3 maunds ...	6·00	Grain ...	159	255	5·67	9·10	8·70	10·87	20·70	4·87	The outturn has been calculated throughtout at the following rate :— Grain 28th lbs per rupee. Straw 205 lbs per rupee.
			Straw	622	363	3·03	1·77					
2	Saltpetre 3 maunds, + bone-dust 4½ maunds.	10·50	Grain ...	518	339	18·50	12·10	23·11	14·34	12·61	3·84	
			Straw ...	946	460	4·61	2·24					
3	Cow-dung 180 maunds ...	7·00	Grain ...	493	140	17·60	5·00	22·27	4·86	15·27	—2·14	
			Straw ...	958	—30	4·67	—·14					
4	Cow-dung 180 maunds + bone-dust 4½ maunds.	11·50	Grain ...	157	460	5·60	16·42	7 70	22·26	—3·80	10·76	
			Straw ...	431	1,198	2·10	5·84					
5	Cow dung 180 maunds + gypsum maunds.	8·50	Grain ...	54	551	1·92	19·67	3·45	23·59	—5·05	15·09	
			Straw ...	315	805	1·58	3·92					
6	Sheep-dung 180 maunds ...	8·00	Grain ...	213	521	7·60	18 60	11·59	22·38	3·59	14·38	
			Straw ...	818	775	3 99	3·78					
7	Ashes of 180 maunds of cow-dung.	1·25	Grain ...	140	121	5 00	4·32	6·78	4·85	5·53	3·60	
			Straw ...	365	109	1·78	·53					
8	Sheep-dung 180 maunds + bone-dust 4½ maunds.	12·50	Grain ...	1,333	521	47·60	18·60	51·45	27·39	38 95	14·89	
			Straw ...	791	1,803	3·85	8·79					
9	Saltpetre 3 maunds, + bone super-phosphate 3 maunds.	17·25	Grain ..	262	817	9 35	29·17	10 76	22 24	6·49	4·49	
			Straw ...	290	-1,432	1·41	—6·93					
10	Sheep-dung 180 maunds + gypsum 3 maunds.	9·50	Grain ...	397	860	14·17	30 71	18 10	36 43	8·60	26 93	
			Straw ...	806	1,174	3 93	5 72					
11	Poudrette 180 maunds ...	7·50	Grain ...	438	751	15·64	26·82	22 45	33·25	14·95	25 75	
			Straw .	1,398	1,319	6·81	6·43					
12	Ashes of 180 maunds of cow-dung + saltpetre 3 maunds.	7·25	Grain ...	95	635	3·39	22·67	5·25	25 00	—2 00	17·75	
			Straw ...	382	478	1·86	2·33					

APPENDIX No. VI.—RABI EXPERIMENT WITH GREEN MANURING, CROP WHEAT, *vide* RABI STATEMENT No. III.

Statement showing the Financial results of manures applied.

Serial number.	Manure per acre.	Cost of manure.	Grain or Straw.	Increase or decrease over the outturn of the unmanured plot per acre.		Value of the increased or decreased outturn		Total value of the increased or decreased outturn.		Net profit or loss after deducting the cost of manure		Remarks.
				Average of last 5 years	1892-93.	Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	Average of last 5 years.	1892-93.	
		Rs.		lbs.	lbs	Rs.	Rs	Rs	Rs.	Rs	Rs.	
1	Old indigo refuse 120 maunds	3 50	Grain ..	581	442	20 75	15·78	27·49	32 04	26 99	28 54	The value of the outturn of wheat has been calculated throughout at the same rates as in the Standard and Duplicate series i.e.:— Grain 28 lbs per rupee. Straw 205 per rupee.
			Straw ..	1,382	3,334	6 74	16 26					
2	Fresh indigo refuse 120 maunds + lime 6 maunds	4·00	Grain ...	1,169	..	41 75	...	49 13	7 43	45·13	3 43	
			Straw	1,513	1,525	7 38	7 43					
3	Indigo water 3,600 cft. ...	3 00	Grain	52	—363	-1·85	-12·96	-1·08	-9·48	-4·80	-12·48	
			Straw ...	12	714	·05	3 48					
4	Hemp water 3,600 cft. ...	3 00	Grain ...	7	25	-2 14	·89	-2 62	4·72	-5·62	1·72	
			Straw ...	99	787	-·48	3 88					
5	Hemp stump ploughed in ..	...	Grain .	61	—84	2 17	-3 00	2·52	-1·59	2·52	-1·59	
			Straw ...	73	290	·35	1 41					
6	Green hemp ploughed in ...	2·00	Grain ...	256	—121	9·14	-4 32	11 76	-·37	9 76	1·63	
			Straw ..	538	811	2 62	3·95					
7	Green Indigo ploughed in ...	6·75	Grain ..	361	73	12·89	2 60	15 96	5·66	9 21	1·09	
			Straw ...	630	629	3 07	3·06					
8	Indigo stump ploughed in ...	...	Grain ..	268	205	9·57	-7 32	12 71	-4 55	12 71	-4 55	
			Straw .	644	569	3·14	2·77					
9	Green Indigo ploughed in + gypsum 6 maunds.	9·75	Grain .	152	158	5 42	5 64	6·10	15·96	3 65	6 21	
			Straw ...	140	2,117	·68	10 32					
10	Green Hemp ploughed in +gypsum 6 maunds.	5·00	Grain ...	131	- 205	4·67	-7 32	5 84	-3 43	-·84	1·57	
			Straw ..	240	799	1·17	3 89					
11	Wheat alternating with Lucerne	...	Grain	—158	...	-5·64	...	-5·43	...	-5·61	..	
			Straw ...	—62	...	·03	...					
12	Wheat alternating with Lucerne.	...	Grain ..	—32	—447	-1·14	-15 96	1 43	13·43	-1·43	-13·43	
			Straw ...	—60	520	-·29	2 53					

APPENDIX VII.

Report on the Cawnpore Experimental Farm by Dr. J. W. Leather, Agricultural Chemist to the Government of India.

THE present site of the Cawnpore Experimental Farm was taken up in 1877-78, but the earliest experiments of a definite nature were initiated by Mr. Fuller, then Assistant Director, Land Records and Agriculture, about 1879-80. The farm has since then remained under the charge of the Assistant Director for the time being: from 1882-84 it was under the direction of Colonel Pitcher, from 1884-92 under Mir Muhammad Husain, and now the present Assistant Director has charge of it.

2. Many of the experiments have been well planned. There are, however, some exceptions, for instance,* Serial Nos. XIII, XIV, XVB, XVC, and in others unnecessarily many plots have been included. Moreover, besides being unnecessary, there have been so many different lots of corn to be weighed at harvest time that recourse has been had to a different and less accurate method of arriving at the outturn than that adopted during Mr. Fuller and Colonel Pitcher's time. At that time the whole of the produce of each plot was (in the case of grain) threshed out, and weighed by the Assistant Director himself. But, when the number of plots increased considerably, all the sheaves of corn from each plot were weighed; then, instead of threshing all out and weighing all the grain, only 100lbs. of each little crop (or plot) was threshed out and its corn weighed, the amount per plot being then obtained by proportion. This was equivalent to about $\frac{1}{4}$ or $\frac{1}{5}$ of the produce only. Thus, any error in weighing, any inequality in the 100lbs. selected, and indeed all the little errors which are ever present in the determination of the outturn per acre are multiplied by 50 or 60, whereas, if the whole produce of each plot (about $\frac{1}{12}$ acre) be threshed out and weighed, the errors are only multiplied by 12.

This latter plan has been re-adopted this year, and I would recommend that it be adhered to in the future.

3. No opportunity has offered itself up to the present of having the manures, &c., employed in the experiments, analyzed. This can, however, now be done by the Agricultural Chemist to the Government of India, and it would be an advantage if average samples of all those materials which can be readily sampled, were forwarded to that officer for analysis. By this means the actual amounts of plant food in the different manures may be determined.

4. Most of the plots at the farm are very small, measuring about 400 square yards each. In manurial experiments the errors which are ever present, due for instance to inequalities of soil, manuring, sowing, &c., &c., are so great that plots should not measure less than $\frac{1}{4}$ acre each, and it would have been better had such been adopted at Cawnpore. This farm has, however, been divided up into small plots, which are separated from each other by fairly wide paths, and it would seem best to leave them as they are, for the present at least.

5. It will perhaps be most convenient, if I refer to the experiments, in some cases singly and in others in groups, and point out, in treating of each, where it might be altered or retained with advantage. The results of the years 1881-82 to 1890-91 are put together in tabular form at the end of the report for the year 1891-92.

6. *The Standard Series.*—This is the oldest experiment and was initiated by Mr. Fuller in 1880. Although it has since been amplified, the principle has been retained and consists in the manuring of four series of plots on which wheat and maize have been grown with different manures.

* See Report on Experimental Farm, 1891-92.

On Series I maize only, and on Series III wheat only, has been grown year by year. On Series II and IV wheat and maize have been grown alternately. In each series there are now 13 plots, and the corresponding plot of each series is treated with the same special manure as its fellow. Plot I of each series, for instance, has been manured with saltpetre for each crop it has borne. The cultivation of each plot has been otherwise identical.

Several of the manures, which have been employed in this experiment, *e.g.*, sheep dung, dung and bone dust, dung and gypsum, are altogether useless for purposes of experiment; these dungs from different animals are themselves somewhat indefinite, and it can answer no good purpose to pit the one against the other. Nor is a mixture of dung and bone or dung and gypsum a *practical* manure. It would never be used by cultivators.

In addition to this it is to be remarked that the dung probably contains nearly as much phosphate and gypsum as the extra dressing of bone or gypsum.

In the case of the application of saltpetre, moreover, this should be applied as a "top dressing" to the crop after it has come up above ground and not with the seed. In the latter case the manure being freely soluble in water is apt to be washed out of the reach of the young plant before it has emerged from the germinating stage.

The plots which are of value are 1 saltpetre, 2 cow dung, 4 poudrette, 5 saltpetre and bone dust, 6 saltpetre and superphosphate, 7 saltpetre and ashes of cow dung, 12 ashes of cow dung, 13 bone dust, 14 super, 15 gypsum, 16 no manure. Of these Nos. 13, 14 and 15 have been discontinued. But since the experiment has been carried out in its present form so long, I would not recommend any alteration. It is always undesirable to introduce changes if they can be avoided.

Looking now at the results, which will be found at pages 17 and 18 of the report, 1891-92, we find that in the main they are fairly concordant and show quite clearly the value of a nitrogenous manure for wheat and maize as distinguished from a phosphatic one. This result in the case of wheat is a corroboration of what English experiments have proved, and the result is a valuable one. The experiment has now been in progress for more than 12 years.

7. The experiment, Series V, VI and VII, is called "*Green soiling.*" A more appropriate name would be "*Green manuring,*" but it does not entirely consist in this, for one part of the experiment is to learn the value of growing wheat after a leguminous crop has been grown and taken off the land, and again the manurial value of indigo refuse is also included.

The results which have been brought out so far are conclusive as to the value of ploughing in of a green crop, and the value of indigo refuse as a manure is also shown. Growing wheat, after an indigo crop has been taken off, is likewise shown to be advantageous, but the wheat crop grown after "*hemp*" (really "false hemp" *crotolaria juncea*, another leguminous plant) has not been increased, either in the same proportion or even regularly. In three out of a series of six years the outturn has been less than that of unmanured plot, whilst the outturn after indigo showed an increase in each year but the last (1890-91), and then there was only a slight difference. Some of the applications are useless. There can be little good in adding gypsum (plot 1) until we know that gypsum *is* a valuable manure for indigo or hemp, a fact which is being tested in another series of experiments. Indigo and hemp water applications are equally useless, for the former can hardly contain much plant food and would be used by the ryot simply as irrigation water whenever it happened to be at hand, whilst as regards the latter (hemp water) it is not, I believe, in the ryot's possession.

The useful plots in this experiment are Nos. 2, 3, 4, 6, 8, 10 and 11, and I would recommend that these be retained, together with plot No. 12 (not entered in the results) on which lucerne is grown in alternation with wheat.

Instead of the present treatment of plots, 1, 5, 7, 9, it might be well to introduce other crops such as *úrd* or *arhar*, after which to grow wheat, and if rape could be got to grow in August (which I am afraid is doubtful), it might be ploughed in as a green crop. For instance, on plot 1 *úrd* and on plot 7 *arhar* might be grown in alteration with wheat as in the case of lucerne, whilst rape might be tried on plot 5 or 9 and ploughed in, if it were found possible to cultivate it in the rains. The plots would then be treated as follows :—

(1) *Úrd* and wheat *alternately*.
(2) Green indigo ploughed in (manure).
(3) Fresh indigo refuse (ditto).
(4) Old indigo refuse (ditto).
(5) Rape ploughed in (ditto).
(6) Indigo and wheat *alternately*.
(7) *Arhar* and wheat *ditto*.
(8) Hemp ploughed in (manure).
(9) Gram and wheat *alternately*.
(10) Hemp and wheat *ditto*.
(11) *Nil*.
(12) Lucerne and wheat *alternately*.

This experiment is really a double one. On the one hand, the wheat is manured *directly* by ploughing in a young green crop which has been grown for the purpose, whilst, on the other hand, it tests the question whether a cereal crop is benefited generally by a preceding leguminous one.

It is a valuable experiment, and whether all the above suggested new treatments are carried out or no, the main experiment should be continued.

8. *Experimental Series VIII and XII.*—These are called the "*Ville*" series, the principle of which is that a manure, containing all the principal plant foods, is applied on one plot (No. 1), whilst in the case of each of the others *one* of the different plant foods is excluded; there is also very properly a "no manure" plot. Again, here we have proof of the value of a nitrogenous manure for wheat, as distinct from phosphatic and potash manures. These experiments have now ceased.

9. Experimental Series XVA (page 21) has the object of testing the effect of manuring indigo with gypsum and it is a valuable experiment. Plot 2 is, however, unnecessary. There can hardly be any advantage in top-dressing with an insoluble substance such as gypsum. It might be well here to test the question as to whether it is *sulphate* or *carbonate* of lime which has the more useful effect on this crop, and this could be done by manuring plot 2 with ground "*kankar*" (which is principally carbonate of lime).

The other part of this experiment, in which the effect of farmyard manure as against farmyard manure and gypsum is tested, is useless—the dung itself containing gypsum, and there can be no good purpose in continuing it.

10. The experimental Series IX, X, XI, XIII, XIV and XVI are all more or less useless. There can be very little object for instance, in testing the value of the dung of different animals; for, if a cultivator has different animals, he would put all the dung together and keep it, as well as circumstances might allow, and he certainly would not (in India at least) keep animals for the sake of making some special dung. Moreover, if such an experiment had to be carried out, it would be necessary to take a number of factors into consideration, the chief among which would be the amounts of water and of plant food in the dungs.

Then, again, in the case of Series XVI most of the materials are of such an indefinite nature that no results worth having could be expected.

In the case of Series X, the testing of the value of refuse from seed-crushing may be important both in relation to the dung which is produced by feeding it to cattle, as likewise to the direct application of such material to the land. In fact, so far as the refuse *castor cake* is concerned, I think it would be well to apply it in the case of any new experiments being commenced in the future.

But the determination of the value of dung produced by animals fed on these materials (oilseed cakes, castor *poonak* excluded) is a much more complex matter and requires great care and attention in carrying it out. Moreover, I am doubtful whether this question has a direct bearing on Indian agriculture at present.

11. *Ploughing experiments, Series I—IV* (*page* 22).—The results obtained in these, some of which were initiated by Mr. Fuller and have been continued since, afford some evidence that the improved plough is advantageous, and the experiment in one form or another might be continued more with the object of demonstrating the value of this implement to the cultivators than to find out anything new.

12. *Irrigation* (*page* 22).—For several reasons I consider this experiment quite useless. It has now stopped, but it may be remarked (1) that when we compare well with canal water we are only experimenting with the water of one well in one district, whilst the water in wells in different parts of the country may, and probably does, vary considerably in composition, and (2) the cultivator irrigates according to whether there is much or little rainfall and does not decide beforehand how often and when he will irrigate.

13. *Methods of sowing* (*page* 23).—Some of these are probably valuable experiments, such for instance, as those in Series I and II (early and late sowing); also it may be desirable to know if a crop is best sown broadcast or in lines and at what distance apart; but I cannot think that any definite result can come from sowing on the top as distinct from the sowing on the side of a ridge.

14. *Varieties of seed* (*pages* 24 and 25).—These experiments should lead to valuable results. It is necessary, however, that they should be continued in a *definite* manner; the seed or crop of each variety should be critically examined each year by experts, and those varieties which prove unsuitable should be "weeded out" and the useful ones only retained. For instance, when the series of experiments on different varieties of cotton was commenced, the cotton was annually submitted to an expert for valuation, but this has latterly been omitted and merely a record of the weight of crop kept. But the value of an experiment is much enhanced if we know which are the better sorts as well as those which produce the greatest weight. Then, if after testing a certain variety for a few years, the outturn be not large and the quality poor, if, in other words, the variety gives no encouragement to grow it, it should be weeded out and only the better sorts retained in the experiment.

Experiments on different varieties of sugarcane, cotton, potatoes and oats may thus lead to valuable results.

On the other hand, I am doubtful if any good end can be served by testing different varieties of wheat and barley, for those which are indigenous are known to be excellent for the purposes of the people.

In the case of the experiments with sugarcane, it would be well if the juice of the different sorts were analyzed at the time of crushing.

15. The experiments on the outturn of indigenous crops is a good one, and will in the course of a series of years afford valuable information.

16. *Conclusion.*—It will be seen from the foregoing that there is ample evidence that the Cawnpore Farm has been productive of valuable information. From its experiments we learn that in India, as in England, wheat is benefited more by an

application of a nitrogenous manure than by a phosphatic one, that the same holds good for maize, that the wheat crop is increased by a preceding leguminous crop, and that it is also increased by the ploughing in of a green crop.

Among implements, too, we find continued evidence of the advantage which accrues in using the deeper plough and the chain pump has been proved the most economical water-raising appliance for certain depths, and has been adopted by the surrounding cultivators.

17. It, therefore, very desirable that those experiments which have been well planned should continue without interruption. I understand that the question of transferring this farm to Lucknow is at present under consideration by the Government, and I would take this opportunity of pointing out the importance of retaining the Farm on its present site for the sake of maintaining continuity of the experiments. The testing of the value of different manurial substances cannot be brought to a successful conclusion in one or two years only—generally indeed a series of at least 10 years is necessary in order to arrive at any positive result. Also it frequently happens that for two or three years after a new experiment has commenced, the results on different plots are irregular owing to the different treatment which they may have previously received. The Cawnpore Farm would appear to possess a suitable site. The soil is similar to a great part of the Ganges-Jumna Doáb. It is fairly level, and there are a number of valuable experiments in progress which should be continued. It would therefore be a pity to interfere with it.

18. Again, the residence of the Assistant Director of Land Records and Agriculture, who has charge of the experiments, is at the Farm, which enables him to give more direct supervision to it than if he lived elsewhere. Indeed, it is very desirable that the Farm should have a prominent claim on the time of the Assistant Director at certain critical periods. For instance, he should be able to devote the whole of his time to it whilst the threshing proceeds, and the weighing of all the crops should be undertaken by him personally. Any mistakes made at this time are particularly serious, and would vitiate the results. At the time of putting on the different manures, too, his presence would be a great advantage in order to ensure their being put on the right plots. These are matters which should not be left to the working Superintendent, whose education has never fitted him for such accurate work.

I cannct help thinking that some of the irregularities which appear in the tables of results, are due to mistakes having been made at one or other of these stages.

19. Agricultural experiments always occasion some considerable outlay, and unless the work is throughly done, the results obtained cannot be depended upon, and the expenditure is in a great measure thrown away.

20. In England, wherever such experiments are entusted to the care of a mere farm bailiff, they are rarely productive of such definite results as would warrant any one placing much reliance upon them, and the need of the constant attention of an educated officer has been established. I feel the necessity of referring to this, because in two cases durring my recent visit, weighings which were taken by the Farm Superintendent were incorrect (one was as much as 30 lbs. wrong), and although *these* happened to be of no great consequence, they were nevertheless supposed to be correct, and are consequently examples of what might occur at other times when such mistakes would be serious. The present Farm Superintendent is, I feel sure, a very good man for the post ; he is energetic and has his heart thoroughly in the work ; but we must not expect him to perform duties for which his training has never fitted him.

21. Finally, I add a note on some experiments of a somewhat different nature, which have been carried out by Babu Lachman Parshad Barmah on some land, which is close to the site of the Experimental Farm, and which appear to me to be of considerable value.

J. WALTER LEATHER,

Agricultural Chemist to the Government of India.

NOTE ON BABU LACHMAN PARSHAD BARMAH'S FARM.

CLOSE to the site of the Cawnpore Experimental Farm is a piece of land which, a few years ago, was so cut up by ravines, that it was rapidly going out of cultivation. A rent of *Rs. 2 per acre* could not be obtained for it.

It was taken up in 1885 by Babu Lachman Parshad Barmah, Personal Assistant to the Director, Land Records and Agriculture, who has since displayed not only great energy, but has likewise met with success in its reclamation. In addition to this, he has carried out a number of experiments upon it on the growing of crops, the results of which are tabulated in Appendix A of the Farm report for 1890-91.

The reclamation was effected by levelling and terracing, and in this way practically the whole of the area of 118 acres has been brought under excellent cultivation. Moreover, the ryots, who had failed to make a living by the cultivation of the land in its former state, have returned, and there is now a very flourishing village which has sprung up entirely during these few years.

Besides the reclamation and the manurial experiments to which reference has been made, there is a fuel reserve of *babul* and *dhak* (*Butea frondosa*) trees, which were planted in 1888-1889. It occupies $1\frac{3}{4}$ acre (·88 acre of each sort of tree), and is intended to demonstrate the value of cultivating firewood, in order to set the dung at liberty for manurial purposes.

The first cutting of firewood has just been made; about $\frac{1}{8}$ of the babul plantation has given 80 maunds. Babu Lachman Parshad informs me that this quantity is sufficient to supply three cultivator's families for one year. Thus the *babúl* plantation is propagated by self-reproduction.

The *dhâk* plantation has not yet been cut.

The operations on this farm form an excellent object lesson. The reclamation is now almost completed, and it is satisfactory to know that it has been a financial success. Regarding the "Fuel Reserve" experiment, the results obtained so far are satisfactory; but such an experiment should be continued for a considerable period after the commencement of cutting. The area, the number of trees, the number of people (or families), using the plantation and the *weight of wood* should be recorded, as also the method employed in propagating the reserve, whether by self-reproduction or otherwise, and what measures adopted for its protection against wilful damage and for the distribution of the firewood.

It seems very desirable that advantage should be taken of any information which may be obtained from this experiment, and with which the owner would no doubt willingly provide the Director, Land Records and Agriculture. If at a future time Babu Lachman Parshad should be compelled, through promotion or other cause, to leave Cawnpore, it would be a great advantage if an arrangement could be made whereby the permanent carrying out of this experiment would be effected.

J. WALTER LEATHER,

Agricultural Chemist to the Government of India.